भारतीय मानक
Indian Standard

IS 16475 : 2015
(Reaffirmed 2019)

भूकृत्रिम — पोलीथीलीन ज्योमैम्बरेन की 2 प्रतिशत छेदक मापांक ज्ञात करने के लिए परीक्षण की विधि

Geosynthetics — Method of Test for Determination of 2 Percent Secant Modulus for Polyethylene Geomembranes

ICS 59.080.70

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भारतीय मानक ब्यूरो
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December 2015 **Price Group 2**

Geosynthetics Sectional Committee, TXD 30

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Geosynthetics Sectional Committee had been approved by the Textile Division Council.

In the formulation of this standard assistance has been drawn from ASTM D5323 – 92 'Standard practice for determination of 2 percent secant modulus for polyethylene geomembranes', issued by the American Society for Testing and Materials, USA.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

GEOSYNTHETICS — METHOD OF TEST FOR DETERMINATION OF 2 PERCENT SECANT MODULUS FOR POLYETHYLENE GEOMEMBRANES

1 SCOPE

1.1 This test method is used for calculating the 2 percent secant modulus for polyethylene geomembranes between 0.5 and 5 mm thickness using test methods given in IS 13360 (Part 5/Sec 1) and IS 13360 (Part 5/Sec 3).

1.2 This practice will facilitate modulus comparisons of similar materials by standardizing the method for deriving the points on the stress-strain curve from which the calculations are performed.

2 REFERENCES

The following standards are necessary adjuncts to this standard:

IS No.	*Title*
13360 (Part 5/ Sec 1) : 1996	Plastics — Methods of testing: Part 5 Mechanical properties, Section 1 Determination of tensile properties — General principles
13360 (Part 5/ Sec 3) : 1999	Plastics — Methods of testing: Part 5 Mechanical properties, Section 1 Determination of tensile properties — Test conditions for films and sheets

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Modulus of Elasticity — The ratio of stress (nominal) to corresponding strain below the proportional limit of a material, expressed in force per unit area, such as Mega Pascals.

NOTE — The stress-strain relations of many plastics do not conform to Hooke's law throughout the elastic range, but rather deviate there from even at strains well below the elastic limit. For such materials, the slope of the tangent to the stress-strain curve at a low strain is usually taken as the modulus of elasticity (or elastic modulus). Since the existence of a true proportional limit in polyethylene is questionable, and with the impracticality of measuring it reliably, the use of secant modulus for comparative evaluations is preferred.

3.2 Secant Modulus — The ratio of stress (nominal) to corresponding strain at any specified point on the stress-strain curve.

NOTE — The measurement units for secant modulus may change, depending on the standard used. For the purposes of this practice, the measurement units shall be force per unit area (F/A), such as Mega Pascals (MPa).

4 SIGNIFICANCE AND USE

4.1 Where to draw the tangent to determine the modulus of elasticity is often unclear when performing tensile tests with polyethylene geomembranes. This problem results in a wide variation in test results and therefore makes this property unreliable for comparisons.

4.2 A secant modulus based on 2 percent strain can be useful when making comparisons between materials, in quality control, and in comparing the same sample after being subjected to a non-standard environment.

4.3 Secant modulus is an approximation of modulus of elasticity and generally results in a lower value than that for the modulus of elasticity.

4.4 Although the technique for measuring 2 percent secant modulus is described here, other percent secant moduli can be measured by this practice.

5 PROCEDURE

5.1 Follow the test procedure described in test methods given in IS 13360 (Part 5/Sec 1) and IS 13360 (Part 5/ Sec 3).

5.1.1 A cross-head speed of 50 mm/min is recommended for determining secant modulus, regardless of the type of geomembrane being evaluated. Faster cross-head speeds reduce resolution of the points on the curve.

5.1.2 High resolution of load and cross-head movement is important for obtaining accurate and reproducible values. Where possible, use settings on the testing equipment that will magnify this region.

5.2 Determine the Load at 2 Percent Strain

5.2.1 The test is conducted without an extensometer. Hence, strain up to the yield point will be based on a gauge length of 33 mm. This represents the reduced area of the specimen. A gauge length of 33 mm requires a cross-head movement of 0.66 mm for 2 percent strain.

5.2.2 Do not compare test results obtained with the use of extensometers to those obtained without the use of extensometers.

5.3 Calculate the 2 percent secant modulus as follows:

$$2 \text{ percent secant modulus} = \frac{\text{Stress}}{\text{Strain}}$$

where

stress = force/area (at 2 percent strain),
area = initial cross-section area, and
strain = 0.02 (for 2 percent secant modulus).

6 REPORT

Report the following information:

a) Complete identification of the material tested, including type, source, manufacturer's code numbers, form, principal dimensions, previous history, and so forth;
b) Method of preparing test specimens;
c) Conditioning procedure used;
d) Ambient temperatures in test room;
e) Number of specimens tested;
f) Speed of testing; and
g) Report the average 2 percent secant modulus value and standard deviation based on the results fromindividual specimens tested from the sample.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Geo-synthetics Sectional Committee, TXD 30

Organization	*Representative(s)*
The Bombay Textile Research Association, Mumbai	Dr. A. N. Desai (***Chairman***) Shri V. K. Patil (*Alternate*)
Brahmaputra Board, Guwahati	Representative
Business Coordination House, New Delhi	Shri Samir Gupta Shrimati Ritika Gupta (*Alternate*)
Central Coir Research Institute, Alappuzha	Director Joint Director (*Alternate*)
Central Road Research Institute, New Delhi	Shri Sudhir Mathur Shri Jai Bahagwan (*Alternate*)
Central Soil and Materials Research Station, New Delhi	Shri Nripendra Kumar Shri Manish Gupta (*Alternate*)
CIDCO, Mumbai	Representative
Department of Jute and Fibre Technology, Kolkatta	Dr Swapan Ghosh Shri K. R. Gupta (*Alternate*)
Directorate General of Supplies and Disposals, New Delhi	Additional Director General (QA)
Ganga Flood Control Commission, Patna	Shri S. Masood Husain Shri Ravi Bhushan Kumar (*Alternate*)
Garware Wall Ropes Ltd, Pune	Shri Tirumal Kulkarni Shri S. J. Chitnis (*Alternate*)
Gujarat Engineering Research Institute , Vadodara	Shri L. V. Ashara Research Officer (*Alternate*)
Indian Jute Industries' Research Association, Kolkata	Shri P. K. Choudhury Shri Koushik Das (*Alternate*)
Indian Jute Manufacture Association, Kolkatta	Representative
In Personal Capacity	Shri V. N. Gore
Kusumgar Corporates, Mumbai	Shri Y. K. Kusumgar Dr M. K. Talukdar (*Alternate*)
Macaferri Environmental Solutions Pvt Ltd, Navi Mumbai	Dr Ratnakar Mahajan
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National Highways Authority of India, New Delhi	Shri R. K. Gandhi Shri R. P. Singh (*Alternate*)
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National Institute of Research on Jute and Allied Fibre Technology, Kolkatta	Dr Gautam Bose Dr Sanjoy Debnath (Alternate)
Office of the Textile Commissioner, Mumbai	Shri Ajay Pandit Shri M. Balasubramanian (*Alternate*)
Premier Polyfilms Ltd, Ghaziabad	Dr Sanjeev K. Verma Shri Harinder Kumar (*Alternate*)
Reliance Industries Ltd, New Delhi	Shri M. S. Verma Shri V. Ravikanth (*Alternate*)
Strata Geosystems (I) Pvt Ltd, Mumbai	Shri Narendra Dalmia Shri Shahrokh Bagli (*Alternate*)
Techfab India, Mumbai	Shri Anant Kanoi Shri Saurabh Vyas (*Alternate*)
The Synthetics & Art Silk Mills Research Association, Mumbai	Dr Manisha Mathur Shrimati Ashwini Sudam (*Alternate*)

Organization	*Representative(s)*
Veermata Jijabai Technological Institute, Mumbai	Dr Prashant Bhave
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Member Secretary
Shri J. K. Gupta
Scientist 'C' (TXD), BIS

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